Catastrophic BioTerrorism: What is to be Done?

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Purpose: Create a Common, Operational, Systemic Understanding

- Absence of a Common Understanding
- Herman Kahn: Thinking about the Unthinkable
- Lenin: What is to be Done?
- Bronson Alcott

Terrorists and Bio Weapons

- Terrorists (other than nihilists) have an agenda
- Most simply, to propagate terror
- Why? To undermine:
  - Confidence in government
  - Will to act
  - Capability to act by diverting resources/focus

Competition Between Terrorists and Government

- For confidence and control
  - Government preparation
  - Improved Performance
  - Confidence
    - Firefighters on 9/11
    - Sailors on the Cole
  - Deterrence

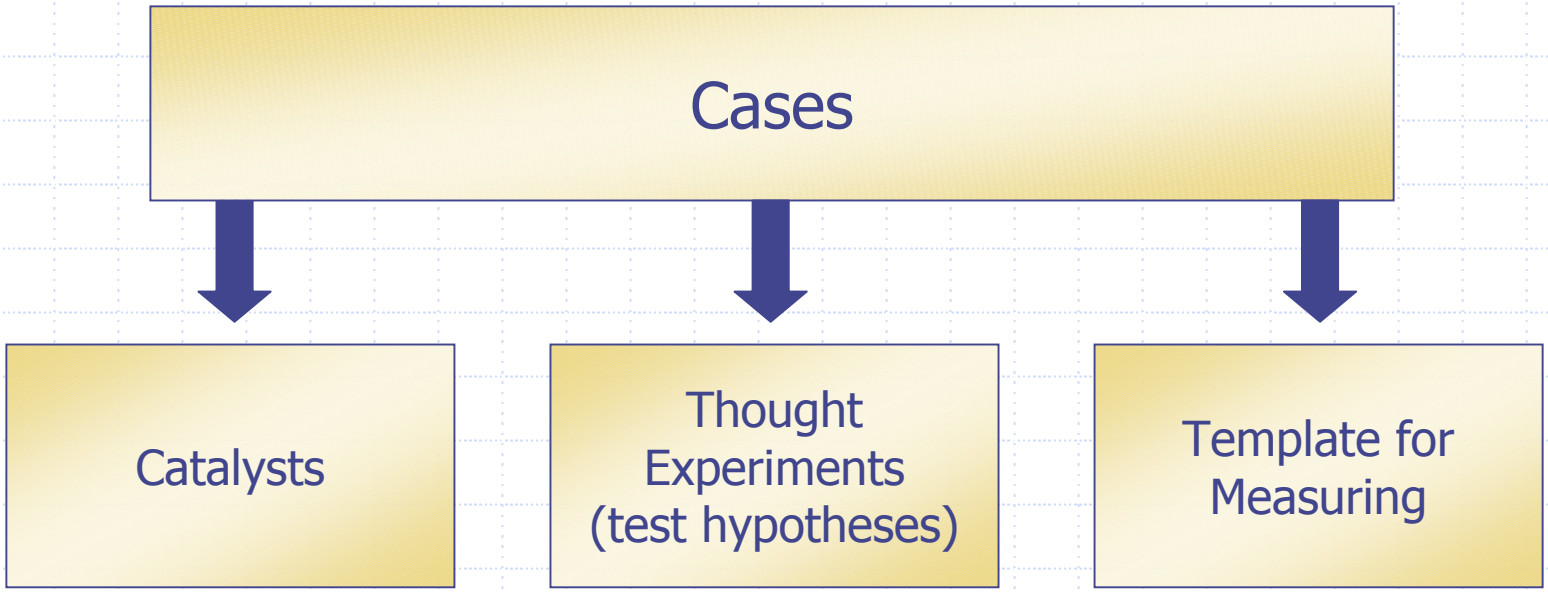
This Brief Aims to Provide:

- Awareness
- Conceptual Framework
- Tools (cases, DISC scores)
- A means of orchestrating varied actors
- Recommendations for action
- Results: Improved Performance and Confidence

Orchestrating Devices

- Planning Cases
  - Anthrax aerosol
  - Smallpox aerosol attack
  - Botulinum commercial drink attack
  - Agriculture attack
- Decathlon Disc
- Temporal Trifurcation
  - Near term (next 2 years)
  - Mid-term (2-5 years)
  - Long term (5-10 years)
- "Case 5"

Using the Planning Cases



Using the Cases

- Strong, Stronger and Strongest Hypotheses
- Strong Hypothesis
  - Responding to these cases is a necessary condition of success for any bio program

These Threats are Now Here

- Anthrax
  - Leahy letter: 1 trillion spores in one gram
  - 20 tons made in Russia
  - Iraq acknowledged program
  - Accessibility to terrorist groups/individuals
- Smallpox (eradicated naturally)
  - Insecurity of Russian sample
  - Other Russian supplies
  - Iraq material from 1970s
  - Extant Microbiologist Samples
  - Genetic Engineering (from Camel pox?)

These threats are now here

- Botulinum
  - Medically available
  - Most poisonous substance known
  - 1/10th of a kilo in drinks can kill
    1 million people

- Agriculture
  - Foot and Mouth virus readily obtained
    - and transported
  - The most contagious virus known
  - US Cattle are unprotected
  - Recent British outbreak
    - $12 billion damage

This Brief will Focus on Cases 1 and 2.

Cases 3 and 4 (in addition to cases 1 and 2) are being discussed with agencies outside DoD.

Hypotheses- continued

- Stronger Hypothesis
  - Responding to these cases will have large collateral benefit for most other threats
- Strongest Hypothesis
  - Other catastrophic cases will be lesser, largely included cases

Recommendations #1 and #2

Adopt the Case Method

In the Near Term, Use the Four Indicated Cases

- to catalyze action
- to measure progress
- to develop a concept of operations

6 Qualifications on Case Use

- Always favor multivalent approaches
- Need research into collateral threats (e.g. into viral hemorrhagic diseases, Rinderpest)
- Need to worry about non-catastrophic bioterrorism
  - E.g. assassinations, anthrax letters, single building attack
  - Military attacks (installations, logistics and forces)
- Risk of Mixed Attacks
- Natural (non-terrorist) risks warrant investment
- Must refresh (update) cases.
  - Our future includes the presently unknown.
  - Basic R&D must be enriched.

New Threats in the Longer Term

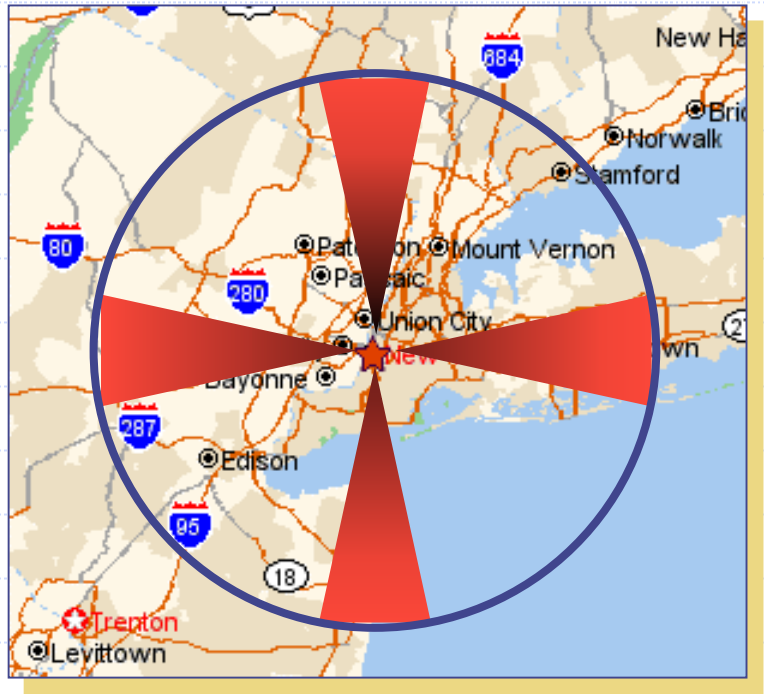
- Mixed attacks
- Genetic modifications of present threats
  - More infectious
  - More virulent
  - Less detectable
  - More easily dispersed
  - Vaccine or drug resistant
- New types of agents
- New modalities

Recommendation #3

- Create a "Case 5" Committee
- Staff it with:
  - Academics at the cutting edge
  - A few from pharma and biotech
  - Infectious disease/3rd world experts
  - Veterinarians
  - Intel experts
- Charge it with:
  - Developing I&W for new cases
  - Promulgating new cases

Case 1: Anthrax Aerosol

- This evening (NY? DC?)
- Several Kilos
- 40 Miles
- Mass exposure – probably undetected
- 24-36 hour first flu manifestations
- high death rate (90%?) if untreated
- Enduring effects from contamination?



The President's First Question

- The Reload Problem
- 5/11 compared with 9/11
- Predictable priorities:
  - Search for intel (how + who)
  - Means of interdiction (e.g. mortar base; crop duster)
  - Pre-positioning of Antibiotics
  - Inoculation
  - Citizen education

Reorientation of Programmatic Perceptions

- Ease of reload distinguishes bioterrorist attack
- Hyper-intense and extensive forensic requirements
- Excruciating allocation decisions
- Economic effects (Poste on interstate commerce)
- Large downwind LD_1 problem
- Conclusion: Federal Management is Imperative

Recommendation #4

- Form a Federal Team now to Advise Senior Decision Makers
  - A "Biological Anti-Terrorism" (BAT!!) Team
  - Build before the event
    - Saves time
    - Induces confidence
    - Can be prepared and trained
- Requires Redundancy
  - British Foot and Mouth Problems with Fatigue

Programmatic Perspectives – Some Further Examples

- Antibiotic resistant anthrax
  - Nation held hostage?
  - Build a triad – vaccines; antibodies; anti-toxins
- Decontamination
  - Demand exceeds the framework that EPA has used;
  - Rewards to prior establishment of standards
- Citizen Preparation (an orphan issue)

DISC Decathlon

- Drugs and Vaccines
- Detectors
- Decontamination

- Interdiction [not a part of this project]
- Intelligence [not a part of this project]

DISC (cont.)

- Surveillance and diagnostics
- Simulation, modeling and gaming
- Counter-proliferation [not a part of this project]
- Civilian hardening
- Consequence management
  - Government management
  - Health care system capability

A DISC Report

- These 10 variables are not uniformly significant
- But comprise a consistent snapshot:
  - 0 = not contributing to our defense
  - 5 = a useful contribution
  - 10 = extremely important contribution
- Descriptive and (for future) predictive
- Not itself prescriptive
  - Empowers prescriptive judgments

DISC Report for Anthrax

Contributor	Now	Mid	Long	Comment
drugs and vaccines	5	7	4	a-b resist;anti-toxin? ;gen eng
detectors	1	2	4	focus on window of reward
decontamination	1	2	4	just inside problem?
intelligence				
interdiction	0	0	1	imperative to rethink
surveillance and diagnosis	7	8	9	ltd reward to further invest
simulation, modeling,gaming	2	7	9	weather and human models
counter proliferation	1	1	2	difficult to impossible?
civilian hardening	0	2	4	filters? Education?
consequence management	1	3	3	rich reqs and opps

Detectors: 7 Functional Roles

- Interdict --- Beyond present capabilities
- Warn --- Potentially effective only at perimeter of attack
- Alert to Avoid
- Alert to Treat
- Assure
- For Forensics
- For Intelligence

Alert Functions Require:

- Wide disposition
  - Low acquisition, operation, maintenance costs
  - Present range $1-2M/month per city
- Modeling in the urban environment
- Close connection to consequence management procedures
- Close attention to “window of reward”
- Very low false positive rate

Implications of a 1% Error Rate (Bayes Theorem)

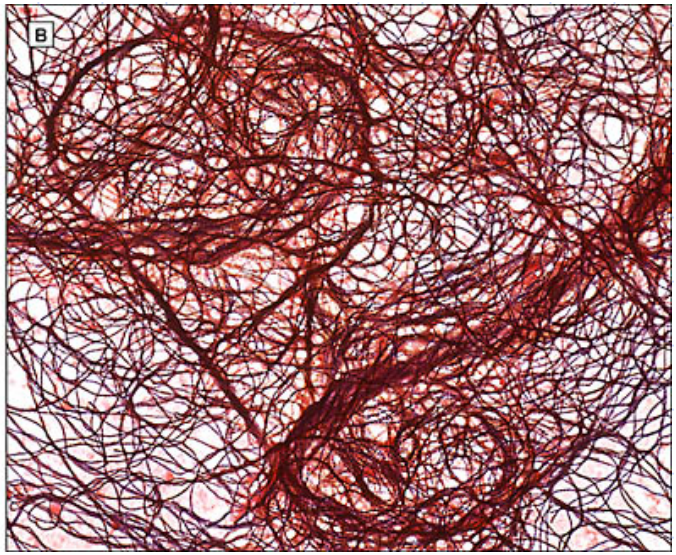
- ~8,735 hours in a year
- 5 hours of attack
  - 297 minutes of alarm with attack
  - 3 minutes (1%) of attack without alarm
- 8,730 hours of non-attack
  - almost 8,643 hours of negative without attack
  - 87.3 hours (1%) of positive w/o attack (false positive)
- Alarm will ring 17X incorrectly for each correct ring

Almost a Six Sigma False Positive Rate is Required

- If ten cities participate, one is attacked once per year, and false positive rate is .01
  - then 175 false alarms for each accurate alarm
- .00001 false positive will assure
  - .175 false alarms for each accurate alarm
  - I.e. >5/6 chance that an alarm is correct
- Complementary technologies can address this problem
- But a detector tech + surveillance (current proposal) does not detect to warn or to treat

Windows of Reward --- Outer Boundary

- A Mass Attack will quickly be evident in our hospitals and to our clinicians
- Gaussian distribution of cases
  - Hypothesis: the "toe" will present in 24-36 hours
- Emergency room population --- doubling at least
- Diagnosis is not difficult



Gram Stain of Blood Culture at 11 Hours of Growth Showing Prominent Gram-Positive Rods, Later Confirmed as Bacillus anthracis
Original magnification 40. Mayer et al JAMA. 2001;286:2549-2553

- Diagnostics and detection are intertwined
  - » Should be viewed as parts of the same system

Window of Reward

- Anthrax: 8-10 Hours
  - Permits Overnight Alert
  - Keep Commuters Out
  - Keep School Children at Home
  - Link to Instructions for Population
    - Turn off air conditioning; seal windows
  - Possible floculation/humidification strategies

Window of Reward

- Smallpox: 24 Hours
  - Extremely high reward to vaccination within 96 hours of infection
  - Requires a response system to achieve this
    - No such system now exists
    - Standby vaccination capabilities are a fraction of those required
  - Existing systems are counter-productive
    - Will prompt loss of confidence in government
    - Will generate divisiveness
      - We are "protecting the protectors"
    - Therefore they will amplify the effects of terrorist attack

A Smallpox 96 Hour Diagnostic Test

- Does not now exist
- Is scientifically plausible
- Has high reward
  - Enables us to minimize vaccination of those who might be exposed, but are contra-indicated
  - Will enable us to target anti-virals
  - A tool for reassurance

Other Implications for Detector R&D

- Reassurance requires:
  - Background information; safety levels
  - Assessment (not just warning) of low presence
    - To what level? LD_{10}? (120 spores?)
  - Very low false negative rate
  - Modeling in urban environment
- Value of individual, cumulative detection
  - Donlon Bio Badge
- Forensic Requirements?